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EVALUATION OF ELEVEN VARIETIES OF MAIZE (*Zea mayz* L.) IN ABAKALIKI AGRICULTURAL AREA, SOUTHEASTERN NIGERIA

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ABSTRACT
Eleven maize varieties were evaluated for their on-farm and off-farm agronomic performance in the Teaching and Research Farm of the Department of Crop Production and Landscape Management, Ebonyi State University, Abakaliki, which falls within the humid forest zone of southeastern Nigeria during the 2008 growing season. The eleven varieties comprised six China varieties (26-517/618, Jinghai 5, Normal corn CAU 541, High oil corn CAU 4515, ND160 China Agric University I and ND160 China Agric University II), three IITA/Nigeria hybrid varieties (Oba 98, Obasuper I and Obasuper II), one CRI Ghana variety (Obatamkpa) and a local check (Ikomwhite). Highly significant difference ($p<0.01$) were observed among the maize varieties for plant height (cm), ear height (cm), days to 50 % silking, number of tassels and yield (t/ha), and difference on days to 50 % tasseling and kernel density at 15.5 % moisture contents (gm) were significant ($p<0.05$). There were no significant differences among the varieties for cob length (cm), cob circumference (cm) and 100 – seed weight at 15.5 % moisture contents (gm). Mean grain yield was significantly ($p<0.01$) higher for IITA/Nigeria hybrid maize varieties and the CRI Ghana variety than for the China varieties and the local check. However, no significant difference was found among the IITA/Nigeria hybrid maize varieties and the CRI Ghana variety although the mean grain yield differed in the order: Oba 98 hybrid > Obasuper II hybrid > Obasuper I hybrid > Obatamkpa.

KEYWORDS: Maize, evaluation, on-farm and off-farm agronomy

INTRODUCTION

Maize (*Zea mayz* L.), is the most important cereal crop in Sub-Saharan Africa and, with rice and wheat. It is one of the three most important cereal crops in the world (IITA, 2006). Maize is a widely adopted crop, capable of producing during the appropriate season in almost part of the world where farming is done (Akande and Lamidi, 2006). Maize is high yielding, easy to process, readily digested, and cheaper than other cereals. Every part of the maize plant has economic value: the grain, leaves, stalk, tassel, and cob can all be used to produce a large variety of food and non-food products (IITA, 2006).

Maize originated from Central America, notably Mexico, from where it spread to other parts of the world. It was introduced into Nigeria in the 16th century by the Portuguse (Future Harvest, 2004). The crop is being cultivated in the rainforest and derived savannah of Nigeria, with an annual production of about 5.6 million tons. The country's maize crop covers about 1 million hectare out of 9 million hectares it occupied in Africa (Okporie, 2000). In Nigeria, the crop is known and called by different vernacular names depending on locality (Obi, 1991).

Maize is represented by many varieties, some producing in as little as 70 days, others needing up to 9 months to reach maturity. Landraces, improved high yielding, pest and disease resistant varieties of maize have been developed (Uguru, 2005).

Before a crop variety is adopted, its yield potential in the target environment has to be evaluated. Hence the objective of this work were to evaluate the yield potentials of eleven varieties of maize from China, IITA/Nigeria and CRI Ghana, using Ikomwhite as a local check in Abakaliki agricultural area of Southeastern Nigeria. This was with the view to identify high yielding genotype(s) for possible introduction and incorporation into breeding programmes.

MATERIALS AND METHODS

The evaluation trial was carried out at in the Teaching and Research Farm of the Department of Crop Production and Landscape Management, Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki, which falls within the humid forest zone of Southeastern Nigeria during the 2008 growing season. The maize varieties used, source of collection and their seed colours, are presented in Table 1.

The experiment was conducted as one way analysis of variance laid out in Randomized Complete Block Design (RCBD) with four replications. The experimental field measured 46.25 m long by 24 m wide, giving a total plot size of 1,110 m^2. Flat beds which were manually tilled were used. Each replicate consisted of eleven plots, which correspond with the eleven varieties, giving a total of forty four (44) test plots. Each plot consisted of one bed, measuring 5 m x 3.75 m. Each bed was divided into five rows. There were 20 plants per row, making a total of 100 plants per plot. Distance between two plots was 0.5 m and plant spacing within the row was 25 cm with rows spaced 75 cm apart.

The treatment comprised of eleven varieties of maize. Seeds were sown at the rate of 2 – 3 per hill and thinned to one plant per hill at 10 – 15 days after seeding (DAS). Seeds were supplied where seeds fail to germinate four (4) days after planting (DAP). Mixed granulated Nitrogen – Phosphorous – Potassium (NPK) 20:10:10 fertilizer at the rate of 350 kg/ha was applied as basal in split doses. First dose (150 kg/ha) was applied three (3) weeks after planting (WAP) and the second dose (200 kg/ha) during the onset of tasselling. Cotrazine selective herbicide was sprayed two days immediately after sowing. Weeds were controlled manually using hoes as often as necessary to keep the plots free from weeds.

Data were collected on the following on-farm agronomic characters: plant height (cm), ear height (cm), days to 50 % tasselling, days to 50 % silking, number of tassels; and off-farm agronomic characters: cob length (cm), cob circumference (cm), yield (t/ha), 100 - seed weight at 15.5 % moisture content (gm) and kernel density at 15.5 % moisture contents (gm).

Statistical analysis of data was based on the procedure for Randomized Complete Block Design (RCBD) for one way analysis of variance (ANOVA) as outlined by Steel and Torrie (1980). The square root transformation method was used to transform data where zero values were obtained. Separation of treatment means for statistical significant effect was by the F-LSD procedure according to Obi (2001). F-LSD test was done at 5% probability level.

RESULTS

The mean square values for the on-farm and off-farm agronomic characters are presented in Table 2. Highly significant difference ($p<0.01$) were observed among the maize varieties for plant height (cm), ear height (cm), days to 50 % silking, number of tassels and yield (t/ha) and, difference on days to 50 % tasseling, and kernel density at 15.5 % moisture contents (gm) were significant ($p<0.05$). Conversely, there were no significant difference among the varieties for cob length (cm), cob circumference (cm) and 100 – seed weight at 15.5 % moisture contents (gm).

The mean for the on-farm agronomic characteristics of the eleven maize varieties are shown in Table 3. Highly significant ($p<0.01$) responses for all the maize varieties evaluated were recorded except days to 50 % tasselling that was significant at 5 % level of probability. The plant and ear heights ranged from 137.20 to 179.50 cm and 26.10 to 52.40 cm respectively. The Normal corn CAU 541 variety recorded the highest plant height (179.50) while ND 160 China Agric University II produced the lowest (137.20 cm). As regards to ear height, Ikomwhite produced the highest ear height (52.40 cm) while ND160 China Agric University II had the lowest ear height of 26.10 cm.

Number of days to 50% tasseling and silking varied from 52.50 to 57.50 and 64.00 to 75.00 respectively. Oba 98 hybrid being the earliest to flower (52.50 days) and Normal corn CAU 541 taking longer period to flower (57.50 days). As regards to days to 50% silking, Obasuper II Hybrid took the longest number of days of 75.00 to silks while High oil corn CAU 4515 and, ND 160 China Agric University I had the least number of days to silk (64.00 days).

Table 1. Source of Collection and Seed Colours of the 11 Maize Varieties

S/no.	Varieties	Source of Collection	Seed Colour
1.	26-517/618	China	Yellow
2.	Jinghai 5	China	Yellow
3.	Normal corn CAU 541	China	Yellow
4.	High oil corn CAU 4515	China	Yellow
5.	ND160 China Agric University I	China	Yellow
6.	ND160 China Agric University II	China	Yellow
7.	Oba 98 Hybrid	IITA/Nigeria	White
8.	Obasuper I Hybrid	IITA/Nigeria	White
9.	Obasuper II Hybrid	IITA/Nigeria	Yellow
10.	Obatamkpa	CRI Ghana	White
11.	Ikomwhite	Nigeria	White

		On-farm Agronomic Characters					Off-farm Agronomic characters				
Source of variation	DF	Plant Height (cm)	Ear Height (cm)	Days to 50% Tasselling	Days to 50% Silking	Number of Tassels	Cob Length (cm)	Cob Circumference (cm)	Yield (t/ha)	100- Seed Wt at 15.5% M.C. (gm)	Kernel Density at 15.5% M.C. (gm)
Block	3	635.34	323.50	74.818	46.67	20.515	30.49	1.223	0.2795	0.184	0.008182
Treatment	10	823.66**	347.92**	13.523*	83.25**	59.518**	23.06^{ns}	3.368^{ns}	2.0159**	0.741^{ns}	0.011636*
Error	30	82.47	66.28	4.802	19.13	4.948	11.31	1.600	0.4282	1.466	0.004848

Table 2. Mean Square Values for the On-Farm and Off-Farm Agronomic Characteristics of Eleven Maize Varieties

**- Plant height (cm), Ear height (cm), Days to 50% silking, Number of tassels ($p<0.01$)

* - Days to 50% tasselling, cob circumference (cm), Yield (kg/ha) ($p<0.05$)

ns- not significant

Table 3. Mean For On-Farm Agronomic Characteristics of Eleven Maize Varieties

Varieties	Plant Height (cm)	Ear Height (cm)	Days to 50% Tasselling	Days to 50% Silking	Number of Tassels
26-517/618	168.50	36.10	54.80	65.50	6.50
Jinghai 5	145.10	30.40	57.00	65.50	8.50
Normal corn CAU 541	179.50	44.20	57.50	74.00	9.80
High oil corn CAU 4515	163.70	39.30	56.00	64.00	7.00
ND160 China Agric University I	156.10	35.60	55.50	64.00	7.80
ND160 China Agric University II	137.20	26.10	56.50	65.50	8.00
Oba 98 Hybrid	179.40	51.80	52.50	70.50	14.30
Obasuper I Hybrid	170.00	44.90	53.50	73.00	10.00
Obasuper II Hybrid	171.60	46.80	53.00	75.00	16.50
Obatamkpa	177.00	50.00	57.30	65.50	16.30
Ikomwhite	174.30	52.40	53.00	74.50	15.00
Mean	165.70	40.70	56.00	68.80	10.90
F-LSD$_{(0.05)}$	16.80**	7.70**	3.00*	6.30**	3.20**

** - Plant height (cm), Ear height (cm), Days to 50% silking, Number of tassels ($p<0.01$)

* - Days to 50% tasselling ($p<0.05$)

Table 4. Mean For Off-Farm Agronomic Characteristics of Eleven Maize Varieties

Varieties	Cob Length (cm)	Cob Circumference (cm)	Yield (t/ha)	100- Seed Wt at 15.5% M.C. (gm)	Kernel Density at 15.5% M.C. (gm)
26-517/618	20.00	17.00	0.24	5.80	1.10
Jinghai 5	21.30	17.10	1.07	5.40	1.08
Normal corn CAU 541	22.50	18.70	0.63	4.90	1.13
High oil corn CAU 4515	25.80	16.70	0.84	4.40	1.08
ND160 China Agric University I	24.90	18.00	1.33	5.20	1.10
ND160 China Agric University II	20.70	17.30	0.27	5.50	1.15
Oba 98 Hybrid	22.20	19.30	2.44	5.70	1.15
Obasuper I Hybrid	19.10	35.10	1.76	5.60	1.18
Obasuper II Hybrid	25.30	19.30	1.85	5.80	1.25
Obatamkpa	23.50	17.40	1.49	5.60	1.20
Ikomwhite	25.80	18.40	0.53	5.80	1.15
Mean	22.80	17.90	1.13	5.40	1.10
F-LSD$_{(0.05)}$	ns	ns	0.9449**	ns	0.1006*

** - Yield (t/ha) ($p<0.01$), * - Kernel Density at 15.5% Moisture Content (M.C) ($p<0.05$), ns- not significant

Number of tassels produced varied significantly ($p<0.01$) among the maize varieties. Obasuper II hybrid had the highest number of tassels of 16.50, followed by Obatamkpa (16.30), while the China variety, 26-517/618 was the lowest (6.50).

The mean off-farm agronomic characteristics of the eleven varieties of maize are shown in Table 4.

There were no significant differences among the maize varieties for cob length and cob circumference. High corn oil CAU 4515 had a moderate cob length of 25.80 cm while Oba-super I produced the best Cob circumference of 35.10 cm.

Mean grain yield was statistically significant ($p<0.01$) among the maize varieties. Oba 98 hybrid had the highest grain yield (2.44 t/ha) followed by Obasuper II hybrid (1.85 t/ha) and 26-517/618 had the lowest (0.24 t/ha). However, IITA/Nigeria hybrid maize varieties and the CRI Ghana variety Obatamkpa were statistical the same.

There were no significant differences among the maize varieties for 100-seed weight at 15% moisture contents while kernel density at 15% moisture contents was statistically significant ($p<0.05$) among the maize varieties evaluated. Obasuper II hybrid had the highest weight of 1.25 gm, which was statistically similar with that of ND 160 China Agric University II, Oba 98 hybrid, Oba-super I hybrid, Obatamkpa and Ikomwhite.

DISCUSSION

The result of the field evaluation trial showed that differences among the 11 maize varieties were highly significant on plant and ear heights (cm), days to 50% silking, number of tassels and yield (t/ha) ($p<0.01$), and significant on days to 50% tasselling and kernel density at 15% moisture contents (gm) ($p<0.05$). These varying characteristics may be due to inherent genetic constituent that is peculiar to each variety. According to Obi (1991), Uguru (2005) and, Akande and Lamidi (2006), different characteristics are controlled by different gene action and so behave differently in a given environment.

As regards to maturity, the entire varieties proved to be late maturing because the earliest maturing varieties took about 64 days to silking. According to Fajemisin (1985), varieties that took more than 50 days to silking is a late maturing maize variety while those below 50 days to silking is early maturing type.

In terms of yield attributes, all the maize varieties differed significantly from each other. Oba 98 hybrid had the highest grain yield (2.44 t/ha) while ND160 China Agric University II produced the lowest yield (0.27 kg/ha). Obi (1991) reported that maximum yield of maize for improved varieties is about 3.5 t/ha and 0.6 to 1.2 t/ha for local varieties.

In comparison with the result obtained, it could be deduced that some varieties are improved types and have the ability of performing well in this agro-ecological zone of the Country. Also, Kim *et al.* (1993), Ajibade and Ogunbodede (2000) and, Akande and Lamidi (2006), demonstrated that normal maize hybrid varieties were known to be superior to other maize varieties in yield potentials.

CONCLUSION

The results clearly showed promising potential grain yield for the hybrid maize varieties with Oba 98 hybrid producing the highest grain yield, followed by Obasuper II and Obasuper I.

The uniform medium sized ears are very important for the farmer to market their products to the factories and again Oba 98 is the front liner in this respect, giving the highest number of medium sized ears. The varieties High oil corn CAU 4515, ND 160 China Agric University I and Obasuper I can be harvested at an earlier period than other varieties.

Following these observation, it is quite reasonable to conclude that the variety Oba 98 hybrid is better than all other varieties in both yield and quality but can be substituted with Obasuper II, Obasuper I and Obatamkpa in the descending order. Further trials are needed with increase in fertilizer application and improved cultural practices to confirm the desirable characteristics of the varieties.

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